tion of the presence of these bodies. One or two writers have recorded the occurrence of sacs with watery contents in different molluscs. The most notable instance known to me is that of *Modiola modiolus*, which, in the Barrow Channel, opposite the Lancashire and Western Sea Fisheries Laboratory at Piel, frequently contains leathery periostracum pearls in the mantle margin, and, associated with these, cysts lined with epidermis, containing watery or mucoid matter. In one of these cysts, some twenty years ago, I found what appeared to be the spores of a protozoon of some kind, but I have not been able to repeat this observation. If sacs of this kind, whether of parasitic origin or due to some pathological condition of the oyster not of parasitic origin, occurred in the Ceylon pearl oyster, and either occasionally burst or normally dehisced to liberate a parasite or its spores, such bodies as small grains of sand, or (as in one of the pearls figured by me) a small quantity of mud containing diatoms, etc., might sometimes be swept into the sacs by the ciliary current and become the "nuclei" of pearls.

The distribution of pearl-producing examples of the various species of molluscs points to the conclusion that the presence of pearls—in other words, the development in the tissues of the mollusc of pearl-sacs—is associated either with parasites which are peculiar to certain localities, or with pathological conditions, following upon particular environmental conditions, which are strictly local in their occurrence. Thus the Ceylon pearl oyster, which produces pearls abundantly in the Gulf of Manar, rarely produces them in Trincomalee Harbour, while the distribution of pearl-producing beds of *Margaritifera maxima* and *M. margaritifera* is still more striking. We find the same local distribution of pearl-producing individuals in the fresh-water pearl mussel Margaritana, and more noticeably in Anodonta.

Personally I am inclined to anticipate that in many of these cases pearl formation will yet be shown to be associated with unicellular parasites. But, whether the pearl-sac is of parasitic origin, or due to some obscure response of the mollusc to a particular set of environmental conditions, it might well prove a highly profitable enterprise to transplant young examples, particularly of such species as *Margaritifera maxima* and *M. margaritifera* from beds where the percentage of pearl production is low, or where pearls are never produced, to some of those beds where almost every individual contains pearls. This process, if successful, would bring the production of pearls into line with the relaying of edible oysters on grounds where the conditions are such as to secure that they will fatten properly for market.

H. LYSTER JAMESON.

Sources and Sinks.

MR. DUFTON'S experiment (NATURE, June 23, p. 522) showing attraction between a source and an equal sink illustrates forcibly a remark by Mr. A. Mallock in the issue for August 19, 1920, p. 777: "In most problems relating to the actual phenomena exhibited by fluids in motion, the simple assumptions on which the hydrodynamical theory of text-books rests are insufficient, and experiments are required." At my suggestion Mr. R. Schlapp has recently been making some experiments on the forces between sources and sinks. The vertical limb (about 80 cm. in length) of a **T**-shaped glass tube dipped into a tank of water, and the horizontal portion rested on **V** supports. One end of this horizontal part was sealed, the other was connected by rubber tubing either to a high-pressure water supply or to a water pump, so that the end of the tube in the tank acted as either a source or a sink. Three types of orifice were used: (*a*) the open end of the glass tube (internal diameter 0·4 cm.)—this worked well as a sink, but was unsatisfactory as a source; (*b*) a hollow brass sphere (diameter 2 cm.) with numerous perforations; (*c*) a short length of rubber tube having the lower end plugged and perforations over about 2 cm. On the whole the last arrangement proved the most convenient, but care had to be taken to ensure that no movement arising from lack of symmetry in the size and spacing of the perforations took place when using an isolated source.

When a single source was in the neighbourhood of a fixed vertical wall, attraction was observed. The attraction was very distinct at small distances, even with a small flow of water. At greater distances and with a stronger source the motion was irregular. Attraction was found also between a sink and a wall.

When two sources were employed it appeared as if they were under the influence of two forces, one attractive and the other repulsive, the former being predominant at distances less than about 2 cm. At such small distances the sources were drawn together and remained in contact as long as the water flowed. Additional evidence for the existence of a repulsive force was afforded by the observation that a fixed source repelled a second tube through which no water was flowing with a force which was greater or less according as the flow of water was large or small; but at small distances the action was attractive. Two sinks attracted one another, no repulsive tendency being observed.

Although Mr. Dufton's experiment showing apparent attraction between a source and a sink in a Winchester bottle was repeated successfully, experiments in an open tank, using the perforated rubber tube as a source and a similar arrangement or an open tube as a sink, showed strong repulsion between source and sink.

It is, of course, obvious that the conditions in such experiments differ in several respects from those assumed in the hydrodynamical theory of sources and sinks in an infinite mass of fluid. H. S. ALLEN.

The University, Edinburgh.

Helicopters.

MR. MALLOCK, in his letter in NATURE of June 30, p. 553, omits the chief reasons for the non-success of helicopters so far.

The first and, to the engineer, most obvious difficulty is the extra weight of moving as compared with fixed wings, and this applies to ornithopters equally.

The second, demonstrated conclusively by Riabouchinsky at the Koutchino laboratory in 1909, and recently rediscovered by ourselves, lies in the phenomenon of mutual and self-interference of the blades of an airscrew, now commonly called the cascade effect.

Each blade blows down the next following in the spiral path, then the other blades in turn, then again itself and the others, the effect becoming fainter as the axial distance from the "image" of itself and the others becomes greater.

In aeroplanes and helicopters, as in all structures which are kept geometrically similar, the weight increases as the cube and the lifting surface as the square of the typical dimension, and though some fining down of large structures can be made in comparison with small, this physical law limits the size alike of the vulture, the elephant, the whale, and the aeroplane. In helicopters the limit comes sooner than in the aeroplane, for the two reasons given above.

If this fundamental relation is ignored, the aeroplane or helicopter will be fortunate if it meets no

© 1921 Nature Publishing Group

worse fate than the ostrich, and merely fails to leave the ground.

A. R. Low.

The Library, Air Ministry,
Kingsway, W.C.2, July 1.

A Prehistoric Cooking-place in Norfolk.

Collectors of Stone-age implements are well acquainted with the calcined flints known as pot-boilers, which are found sparsely strewn over the sites of most prehistoric settlements. As the sun-baked pottery of the kitchen utensil would not stand the fire, heated flints were thrown into the vessel to bring the water to the boil.

My attention having been directed by Mr. Baldry, of Cranwich, to a mound in Buckenham Tofts Park, Norfolk, where the moles were throwing out a remarkable number of these pot-boilers, with the kind permission of the owner, Mr. Underdown, I started excavations on the spot in May last with the view of discovering their origin.

Owing to numerous springs taking their rise at a somewhat high level in the park, the old chalk land surface has been carved out by water action into a series of large natural folds, which at first sight might appear artificial. On one of these, where the burnt stones are found in great profusion, we commenced operations, running a trench from the west side up the slope, a distance of 66 ft., and another near the starting-point at right angles to it. About 8 ft. from the base of the fold, and in close proximity to a stream, on removing about 3 in. of surface-grass and mould, we at once came upon a compact mass of pot-boilers. These continued to a depth of $2\frac{1}{2}$ ft., resting upon blackened earth, which when dug through was found to be lying on the chalk. Tracing the calcined stones from the base of the mound upwards, many thousands came to light, ever decreasing in numbers as they approached the summit, as though thrown out from the spot on which they had been used.

The finding of remains of what appeared to be a great communal kitchen was extremely puzzling, and only when I got into communication with Mr. Cantrill, of the Jermyn Street Museum, did a possible clue present itself. Mr. Cantrill had published in *Arch. Cambrensis* accounts of his investigations of similar stone-boiling sites in Wales. His papers also refer to quite a number of these prehistoric cooking-places, known as "deer roasts" or "giants' cinders," in Ireland, and I am now informed by Mr. Crawford that they are not unknown in Scotland. In England, Mr. Cantrill tells me, they have never yet been examined.

These accumulations are supposed to have been the large cooking-hearths where the flesh of the red deer or other big game was boiled. The finding of hollowed tree-trunks in some of these mounds in Ireland suggests that a trough of this kind was sometimes used to contain the water. Mr. Cantrill suggests that another alternative would have been to dig a hole in the chalk and line it with a raw hide to serve as a cooking vessel. To boil such a great amount of water heated stones in large quantities would have been ladled into the vessel.

So far no satisfactory evidence as to the date of these places appears to have been forthcoming. A general opinion, however, seems to prevail that they are of Neolithic origin. This view may be substantiated by our finding among the pot-boilers quite a number of humanly struck flint flakes showing bulbs of percussion. Still more interesting was the discovery of what appears to have been a small circular pit dwelling within a few yards of the heap of pot-boilers. It measured 11 ft. in diameter. Opening this out, we came upon a hearth of quite normal appearance—flints reddened by the fire, with a few pot-boilers strewn about, and an area of blackened earth. Here it was evident that some individual had sat and fashioned his flint tools, for flakes lay about in profusion, with spalls and a fine core. A scraper of unusual form, but strongly reminiscent of some of those found at Whitepark Bay, in Ireland, lay among flint knives and other small tools, while an arrow-point, worked on both sides and with one barb already punched out, may possibly by its workmanship give the required date to these mysterious sites. Further examination of the Buckenham Tofts mound will, it is hoped, be made in the near future under the auspices of the Percy Sladen Trust.

Nina F. Layard.

Science and Civilisation.

May I venture, as a citizen, to make an appeal to men of science and to urge that the time has come when they should no longer stand aside from the social and political questions that vex the world? Science is itself dependent upon favourable social conditions: that these conditions can abruptly cease has been clearly shown in the case of Russia. Scientific workers have therefore the strongest class interest in the social conditions under which they live. They have, however, more than a class interest. Science has made civilisation possible for mankind. It must now provide civilisation with that authority the lack of which is causing such waste of human energy to-day. Men of science alone have the power; they alone are above suspicion.

This is no place for details. An international amalgamation of existing scientific organisations would provide the world with an intellectual aristocracy, independent of the vote, which by the development of knowledge and the control of new weapons, lethal and industrial, would soon acquire the necessary influence.

B. J. Marden.

Stodham Park, Liss, Hampshire, June 30.

Measurement of Small Inductance.

The method of suspending a loop of wire in a uniform alternating magnetic field, as used by Fleming and Elihu Thomson for the construction of A.C. galvanometers, can be applied with advantage to determine the self-inductance of loops in absolute measure, and it would seem that we can go considerably lower in this way than can conveniently be done otherwise. Low-frequency measurements are inaccurate, but with a triode at wireless frequencies I have measured inductances from 20 cm. to 50,000 cm. with an average error of $1\frac{1}{2}$ per cent. without special precautions to obtain sensitiveness. The details of the experiment will appear shortly in the *Philosophical Magazine*.

F. B. Pidduck.

Queen's College, Oxford, July 2.

A New Acoustical Phenomenon.

The phenomenon described by Dr. Erskine-Murray in a letter under the above heading in Nature of June 16 (p. 490) is particularly well heard when one is standing near a cliff or rock-face and listening to the sound of a waterfall or of the waves breaking on the seashore. The phenomenon is, of course, familiar to physicists, but it may not be so well known that use can be, and indeed often is, made of this effect in avoiding obstacles when one is walking in the dark. No doubt blind men, consciously or unconsciously, use it in this way; and it must have been so used from remotest antiquity by man and any other animals which happened to have the necessary discriminating power in hearing.

G. A. Shakespear.

The University, Birmingham, July 8.

© 1921 Nature Publishing Group